

**WHAT IS CLAIMED IS:**

1     1.     Method for estimating the degradation of the trapping capacity of a NO<sub>x</sub>-Trap  
2     catalytic converter, which method provides for performing a first NO<sub>x</sub> regeneration  
3     process of a predetermined duration, determining whether the actual duration of the  
4     first NO<sub>x</sub> regeneration process is equal to the predetermined duration and assuming  
5     that the trapping capacity is unchanged if the actual duration of the first NO<sub>x</sub>  
6     regeneration process is equal to the predetermined duration; the method being  
7     characterised in that, if the actual duration of the first NO<sub>x</sub> regeneration process is  
8     less than the predetermined duration, at least one corrective action is performed in  
9     order to attempt to counteract the degeneration of the NO<sub>x</sub>-Trap catalytic converter,  
10    a subsequent NO<sub>x</sub> regeneration process is performed, it is determined whether the  
11    actual duration of the subsequent NO<sub>x</sub> regeneration process is equal to the  
12    predetermined duration, if the actual duration of the subsequent NO<sub>x</sub> regeneration  
13    process is equal to the predetermined duration, then new characteristic operating  
14    parameters for the corrective action are used for the subsequent life of the NO<sub>x</sub>-  
15    Trap catalytic converter whereas, if the actual duration of the subsequent NO<sub>x</sub>  
16    regeneration process is less than the predetermined duration, the estimated trapping  
17    capacity (C) of the NO<sub>x</sub>-Trap catalytic converter is reduced.

1     2.     Method according to Claim 1, in which the signal of an ON/OFF type lambda  
2     sensor arranged upstream from the NO<sub>x</sub>-Trap catalytic converter is used to  
3     determine whether the actual duration of a NO<sub>x</sub> regeneration process is equal to the  
4     predetermined duration.

1     3.     Method according to Claim 2, in which, if no transition in the signal from the  
2     lambda sensor is detected during the NO<sub>x</sub> regeneration process, then it is assumed  
3     that the actual duration of the NO<sub>x</sub> regeneration process is equal to the  
4     predetermined duration whereas, if a transition in the signal from the lambda sensor  
5     is detected during the NO<sub>x</sub> regeneration process, then it is assumed that the actual  
6     duration of the NO<sub>x</sub> regeneration process is less than the predetermined duration.

1     4.     Method according to Claim 1, in which the corrective action provides for  
2     increasing the operating temperature of the NO<sub>x</sub>-Trap catalytic converter; if the  
3     actual duration of the subsequent NO<sub>x</sub> regeneration process is equal to the

4 predetermined duration, then the minimum value of the operating temperature of  
5 said NOx-Trap catalytic converter is increased for the subsequent life of the NOx-  
6 Trap catalytic converter.

1 5. Method according to Claim 4, in which the minimum value of the operating  
2 temperature of the NOx-Trap catalytic converter is not increased beyond a  
3 respective predetermined threshold value.

1 6. Method according to Claim 4, in which the operating temperature of the NOx-  
2 Trap catalytic converter is increased by means of a number of successive  
3 increments of a determined size; after each increment, the performance of a  
4 subsequent NO<sub>x</sub> regeneration process is awaited and, if the actual duration of the  
5 subsequent NO<sub>x</sub> regeneration process is less than the predetermined duration, then  
6 a further increment is performed whereas, if the actual duration of the subsequent  
7 NO<sub>x</sub> regeneration process is equal to the predetermined duration, then  
8 incrementation of the operating temperature of the NOx-Trap catalytic converter is  
9 ceased and the minimum value of the operating temperature of said NOx-Trap  
10 catalytic converter is increased.

1 7. Method according to Claim 6, in which the value of the operating temperature  
2 of the NOx-Trap catalytic converter is not increased beyond a respective  
3 predetermined threshold value.

1 8. Method according to Claim 1, in which the corrective action provides for  
2 performing an unscheduled desulfation process and, on completion of the  
3 unscheduled desulfation process, awaiting performance of a subsequent NO<sub>x</sub>  
4 regeneration process; if the actual duration of the subsequent NO<sub>x</sub> regeneration  
5 process is equal to the predetermined duration, then the temperature value of the  
6 NOx-Trap catalytic converter is incremented and the average value for ratio used  
7 during future desulfation processes is decremented.

1 9. Method according to Claim 8, in which the temperature value of the NOx-Trap  
2 catalytic converter and the average value for ratio used during the desulfation  
3 processes are not modified beyond respective predetermined threshold values.

1 10. Method according to Claim 1, in which the corrective action provides for  
2 increasing the operating temperature of the NOx-Trap catalytic converter; if the

3 actual duration of the subsequent NO<sub>x</sub> regeneration process is equal to the  
4 predetermined duration, then the minimum value of the operating temperature of  
5 said NO<sub>x</sub>-Trap catalytic converter is increased for the subsequent life of the NO<sub>x</sub>-  
6 Trap catalytic converter; if the actual duration of the subsequent NO<sub>x</sub> regeneration  
7 process is less than the predetermined duration, then an unscheduled desulfation  
8 process is performed and, on completion of the unscheduled desulfation process,  
9 performance of a subsequent NO<sub>x</sub> regeneration process is awaited; if the actual  
10 duration of the subsequent NO<sub>x</sub> regeneration process is equal to the predetermined  
11 duration, then the temperature value of the NO<sub>x</sub>-Trap catalytic converter is  
12 incremented and the average value for ratio used during future desulfation  
13 processes is decremented; if the actual duration of the subsequent NO<sub>x</sub>  
14 regeneration process is less than the predetermined duration, then the estimated  
15 trapping capacity of the NO<sub>x</sub>-Trap catalytic converter is reduced.

1 11. Method according to Claim 10, in which the operating temperature of the  
2 NO<sub>x</sub>-Trap catalytic converter is increased by means of a number of successive  
3 increments of a determined size; after each increment, the performance of a  
4 subsequent NO<sub>x</sub> regeneration process is awaited and, if the actual duration of the  
5 subsequent NO<sub>x</sub> regeneration process is less than the predetermined duration, then  
6 a further increment is performed whereas, if the actual duration of the subsequent  
7 NO<sub>x</sub> regeneration process is equal to the predetermined duration, then  
8 incrementation of the operating temperature of the NO<sub>x</sub>-Trap catalytic converter is  
9 ceased and the minimum value of the operating temperature of the NO<sub>x</sub>-Trap  
10 catalytic converter is increased.

1 12. Method according to Claim 11, in which the value of the operating  
2 temperature of the NO<sub>x</sub>-Trap catalytic converter is not increased beyond a  
3 respective predetermined threshold value.

1 13. Method according to Claim 1, in which the predicted value for the duration of  
2 the NO<sub>x</sub> regeneration process is calculated using a storage model of the NO<sub>x</sub>-Trap  
3 catalytic converter, said model being based on an estimate of the trapping capacity  
4 of the NO<sub>x</sub>-Trap catalytic converter, such that the NO<sub>x</sub> regeneration process only  
5 lasts for the time that is strictly necessary to remove the NO<sub>x</sub> groups trapped in the  
6 NO<sub>x</sub>-Trap catalytic converter.